

## REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons which follow.

After amending the claims as set forth above, claims 112 and 119-137 are now pending in this application.

The present invention concerns screening methods for identifying anti-bacterial agents binding to or inhibiting the activity of bacterial targets. As described in the specification, these methods utilize the fact that the Applicants were the first to identify anti-microbial bacteriophage proteins bind specifically to particular bacterial targets. According to the invention, the protein:protein interaction between the bacteriophage protein and the identified bacterial targets allows screening and development of anti-bacterial agents active on the bacterial targets. The elected claims concern one particular bacterial target, the DNA-directed DNA polymerase III beta subunit protein (dnaN).

Applicants appreciate the Examiner's indication that Claim 112 would be allowable if rewritten or amended to overcome the rejection under 35 U.S.C. 112, second paragraph. Claim 112 has been modified as suggested by the Examiner, thus obviating the rejection.

New claims 119 to 133 are submitted, replacing former claims 81 to 111. New claims 134 to 137 have also been added. The new claims are fully supported by the original specification as filed and no new matter has been added. More particularly:

- claim 119 corresponds substantially to former claim 81;
- dependant claim 119 is supported by page 65, line 20 to page 66, line 22; and Figure 5B;
- dependent claim 121 corresponds substantially to former claim 111 and is supported also by page 68, line 26 to page 70, line 16;
- claims 122 to 124 correspond substantially to former claims 116 to 118;
- new claim 125 is supported by page 68, line 26 to page 70, line 16;

- claim 126 corresponds substantially to former claim 82;
- claim 127 corresponds substantially to former claim 84 and is supported by page 68, line 26 to page 70, line 16;
- 128 to 132 correspond substantially to former claims 83 to 91 and are supported by Examples VII and VIII at pages 68 to 75;
- claim 131 corresponds substantially to former claim 92;
- claims 132 and 133 are supported by the whole specification and more particularly by page 75, line 4 to page 76, line 10;
- claims 134 and 135 are supported by the whole specification and particularly by page 16 lines 14 to 21; and page 25, line 15 to page 27, line 17; and
- claims 136 to 137 are supported by the whole specification and more particularly by page 75, line 4 to page 76 line 10.

## **OBJECTIONS TO THE SPECIFICATION**

The Examiner objected to the inclusion of a hyperlink and/or other form of browser-executable code at particular locations in the specification, including on pp. 22, 23, 31, 59, and 60.

The text on pages 22 and 23 objected to by the Examiner in the outstanding Office Action contains information providing electronically accessible addresses, but that information is not in browser-executable form. Similarly, in the response filed September 24, 2002, Applicants amended page 59 and 60 of the specification to transform the hyperlink references to provide electronically accessible address information not in browser-executable form. The Examiner declined to enter that amendment as a clean copy of the amended paragraph was not provided. Applicants submit herein the amended paragraph. In addition, Applicants further submit additional amended paragraphs on pp. 31, 59, 72, and 75, such that each of the amended paragraphs provide electronically accessible address information that is not in browser executable form.

Applicants respectfully submit that the specification as amended provides the information to allow a person to access the indicated sites, but that site information is not in browser-executable form and therefore is in accordance with MPEP 608.01. Therefore, Applicants submit that pages 22, 23, 59 and 60 of specification are in a suitable form, and request that the Examiner reconsider and withdraw the objections.

At paragraph 7 of the Action, the Examiner also alleged that Tables 1 to 8 are missing from the application. As already pointed out with the response filed September 24, 2002, Tables 1 to 8 were included in the specification submitted to the Patent Office on December 1, 2000. The receipt acknowledgement postcard returned by the Patent Office, on which the Tables were specifically noted, evidences that submission. A copy of that postcard is attached for the Examiners' reference. Since Tables 1-8 appear to have been separated from the remainder of the specification and the Examiner has been unable to locate those tables, replacement copies of Tables 1-8 are attached. Applicant requests that the Examiner re-insert Tables 1-8 in the specification.

#### **CLAIMS REJECTIONS UNDER 35 U.S.C. § 101**

The Examiner rejected claims 81 to 96 and 111 under 35 U.S.C. 101 allegedly because the claimed invention is allegedly not supported by a specific, creditable and substantial utility. Applicant respectfully traverses these rejections as they may be considered in connection with the present claims.

In support of these rejections, the Examiner provides a list of references disclosing amino acid and nucleic acid sequences encoding very short amino acid sequences (5 to 10 amino acids) sharing 100% sequence identity with portions of SEQ ID NO: 99 (corresponding to ORF 25 of 44AHJD). The Examiner alleges that those short sequences demonstrate that such fragment would not serve to identify an antimicrobial agent, and that a test compound binding to such fragments would not evidence any specificity for DnaN of *S. aureus*. The Examiner further

asserted that the specification does not disclose fragments of ORF25 products that correlate or have a well established utility known in the art as being specific, substantial and credible.

The Applicants would like to point out that present screening claims specify that the bacteriophage and bacterial polypeptides bind specifically to each other, i.e., specific binding between an a phage 44AHJD ORF25 polypeptide and *S. aureus* dnaN polypeptide. None of the sequences cited by the Examiner would have that property. As a result, Applicants respectfully submit that the putative fragments cited by the Examiner are not relevant to the instant invention, and do not provide evidence of lack of utility. To the contrary, the specific interaction specified in the present claims establishes a credible, substantial utility for screening for compounds that have antibacterial activity on *S. aureus* dnaN.

With respect to the Examiner's assertions concerning lack of description of fragments of ORF 25 polypeptide product, the specification provides description that effectively does describe such fragments. For example, fragments having one (or more) amino acids deleted from either the N-terminus or C-terminus are indicated at p.50, line 6. Similarly, fragment that include, for example, 80% and 90% of the full-length polypeptide are indicated on p.4. In addition, Applicants respectfully submit that one ordinary skill in the art recognizes that protein-protein binding interactions typically involve only a portions of full-length polypeptides, and that derivatives of the full-length polypeptide can typically be formed that retain the specific binding activity of the full-length polypeptide.

△ [ Indeed, one can readily utilize the information provided in the present application to identify derivatives of bacteriophage proteins with inhibitory activity that are still capable of specifically interacting with a specific bacterial target. A number of techniques useful for such identification are described in the specification. Furthermore, it is common knowledge of skilled artisan to produce biologically active fragments or mutants of an original protein. In fact, numerous such fragments related to various phage polypeptide/bacterial pairs have been identified, as shown in the attached Declaration of Dr. Michael Dubow, who is one of the inventors. The Declaration demonstrates that fragments of bacteriophage proteins binding to

bacterial targets have been identified, as well as fragments of bacterial targets bound by bacteriophage proteins.

In view of the above, the Applicants respectively request that the Examiner reconsider and withdraw the rejections.

### **CLAIMS REJECTIONS UNDER 35 U.S.C. § 112, FIRST AND SECOND PARAGRAPHS**

The Examiner has rejected claims 81 to 96 and 111 under 35 U.S.C. 112, first and second paragraphs. The Examiner alleged that the present specification does not describe any sequences related to ORF25 or *S. aureus* dnaN other than those represented by SEQ ID NO: 99 and 2 respectively. Applicant respectfully traverses these rejections as they may be considered in connection with the present claims.

First, Applicants submit that the new claims obviate the Examiners' rejection under 35 U.S.C. § 112, first paragraph because the new claims are now restricted to bacteriophage ORF25 polypeptides and *S. aureus* dnaN polypeptides that specifically bind one with the other, in accordance with the discussion in connection with the rejections under 35 U.S.C. § 101.

In connection with the Examiner's rejection in paragraphs 13-18 of claims 81-93 under 35 U.S.C. § 112, second paragraph, the present claims specify a binding or protein:protein interaction between the ORF25 polypeptide and the dnaN polypeptide, thus obviating the Examiner's rejections.

Concerning the Examiners' rejection of former claims 85 to 91 in paragraphs 19-21 as allegedly omitting essential elements, Applicants respectfully submit that the subject matter of these claims refer to measurement techniques which are well known in the art, such that it is not necessary to provide obvious details or steps. Because the techniques referred to are routine in the art and one of ordinary skill in the art will know, depending on his exact needs, whether the products need to be labeled or not, how to determine whether there is a "positive" interaction, how to make the right measurement, specific reagents, etc., and recognizes that such particulars

will often vary between applications and between particular variations of those techniques. Thus, by pointing out certain techniques that can be used, one of ordinary skill in the art knows how to apply those techniques in particular applications without specification in the claims of particular reagents and the like. Therefore, contrary to the Examiner's assertions, the claims do not omit essential steps. In fact, requiring specification of such particulars is an impossibility due to the many variations that can be performed. Thus, the present claims specify the techniques in the appropriate manner.

Therefore, Applicants respectfully request that the Examiner reconsider and withdraw these rejections.

With respect to claim 112, the term --the-- has been added to the claim, as suggested by the Examiner.

Accordingly, the Applicants respectfully submit that the present claims overcome or render moot the Examiners' objections.

#### **CLAIM REJECTIONS UNDER 35 U.S.C. § 102**

The Examiner rejected former claims 81 to 86, and 92 to 96 as allegedly being anticipated by Loessner et al (Journal of Bacteriology 181:4452-4460, August 1999). The Examiner asserted that Loessner discloses a homolog of 44 AHJD ORF25 product, and associated methods as claimed. Applicants respectfully traverse this rejection as it may be considered in connection with the present claims.

The failure of Loessner et al. to anticipate the present claims is shown by at least three considerations. First, Loessner et al. do not describe a method for screening for antimicrobial agents, but rather describe identification and analysis of a bacteriophage-encoded putative holin protein, Hol187, encoded out of frame within an endolysin gene. Secondly, the bacteriophage protein disclosed by Loessner et al. (Hol187) shares only 12% sequence identity with the ORF25 polypeptide, a percentage of identity well outside the definition provided for a homolog in the

present application, which states that a homolog comprises at least 35% amino acid sequence identity over at least one sequence window of 18 amino acid residues or more (page 6, lines 12 to 15). Thirdly, Loessner does not describe any determination of specific interaction or change in interaction between the bacteriophage protein and *S. aureus* dnaN or even a dnaN homolog.

Therefore, in view of those distinctions and contrary to the Examiner's assertions, Loessner et al. cannot anticipate the present claims. Therefore, Applicants respectfully request that the Examiner reconsider and withdraw the rejection.

### **CONCLUSION**

In view of the foregoing remarks, Applicants respectively submit that the present claims are allowable, and request a notice to that effect.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

No fee is believed due in connection with this communication. However, if any fee is due, kindly charge the appropriate amount to Deposit Account 50-0872.

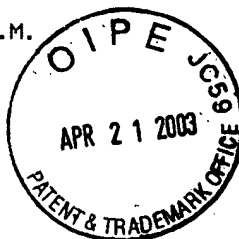
Respectfully submitted,

Date 17 April 2003

By Wesley B. Ames

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Atty. Dkt. No. 073406-0410

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant: Jerry Pelletier, et al.

Title: DNA SEQUENCES FROM  
STAPHYLOCOCCUS AUREUS  
BACTERIOPHAGE 44AHJD THAT  
ENCODE ANTI-MICROBIAL  
POLYPEPTIDES

Appl. No.: 09/727,892

Filing Date: 12/01/2000

Examiner: Portner, Virginia Allen

Art Unit: 1645

**RECEIVED**

APR 23 2003

TECH CENTER 1600/2900

**DECLARATION OF DR. MICHAEL DUBOW**

Commissioner for Patents  
Washington, D.C. 20231

Sir:

I declare that:

1. I am one of the joint inventors of the above identified US patent application. I am also one of the three co-founders of PhageTech Inc., the Assignee.
2. I have been a Professor at McGill University, Montréal, Québec, Canada for 22 years. I am presently Professor at Université Paris-Sud, Orsay, France. I have worked in the field of genomics and proteomics for at least 10 years. A copy of my CV is attached as Annex 1.
3. I have reviewed the specification and the claims of the above-captioned application, as well as the Office Action mailed January 17, 2003 concerning the patent application US 09/727,892.
4. The following work was performed under my direction or subject to my review, and was performed using the guidance provided in the present specification and routine knowledge in the field.



Atty. Dkt. No. 073406-0410

5. A number of fragments of inhibitory bacteriophage proteins have been identified. Some examples of bacteriophage protein fragments that retains bacteria inhibitory activity which have been produced include.

- a) a 135 amino acids (AA) fragment corresponding to residues 107-241 of open reading frame (ORF) No. 18 from *S. aureus* phage 52A (full length ORF = 241 AA);
- b) a 157 AA fragment corresponding to residues 99-255 of ORF No. 15 from *S. aureus* phage 107 (full length ORF= 255 AA);
- c) a 129 AA fragment corresponding to residues 107-235 of ORF No. 16 from *S. aureus* phage X2 (full length ORF = 235 AA);
- d) four (4) fragments having 51, 46, 40 and 35 AA respectively and corresponding to residues 1-51, 5-51, 1-40, 5-40 of ORF No. 168 from *S. aureus* phage Twort (full length ORF = 78 AA); and
- e) a 149 AA fragment corresponding to residues 50-198 of ORF No. 67 from *S. aureus* phage G1 (full length ORF = 198 AA).

6. For any identified active fragment from an inhibitory bacteriophage protein, additional active fragments can readily be made having additional amino acid residues from the full length protein, up to the full length protein.

7. Mutants of bacteriophage proteins with bacteria inhibitory activity can be readily identified. For example, this can be done by simply deleting, adding or mutating one or more amino acids of the inhibitory bacteriophage proteins (using PCR methodologies) and testing these mutants for inhibitory and binding activities. Indeed, it is common knowledge of skilled artisans to produce biologically active fragments or mutants of an original protein.

8. Similarly, homolog(s) of bacterial target(s) can readily be identified by using inhibitory bacteriophage proteins (or variants thereof) and routine protein:protein interaction measurements. Actually, this is one of the main reasons why the method of the present invention is so powerful in identifying bacterial targets because it is not necessary to know

Ally. Dkt. No. 073406-0410

either the biological activity of the target (i.e. an unknown protein, a homolog, or a fragment of a previously identified protein) or its structure: it is the inhibitory bacteriophage protein that fishes out the "right" target.

9. In addition, a number of fragments of bacterial target proteins that retain binding for the corresponding inhibitory bacteriophage proteins have been identified. Some examples of such bacterial target fragments which have been produced include:

- a) two (2) DnaI fragments having 250 and 164 AA respectively, corresponding to residues 64-313 and residues 64-313 (full length DnaI = 313 AA), the full-length DnaI and the two fragments interacting with ORF No. 104 from *S. aureus* phage 77;
- b) seven (7) DnaG fragments having from 564 to only 38 AA corresponding to residues 229-599, 380-599, 449-599, 490-599, 530-599, and 561-599 respectively (full length DnaG = 599 AA), the full-length DnaG and the seven fragments interacting with ORF No. 78 from *S. aureus* phage 96. In addition, the shortest 38 AA fragment was tested and shown to retain activity of binding to *S. aureus* DnaC helicase possessed by the full-length native DnaG protein; and
- c) two (2) sigma 70 fragments having 242 AA and 75 AA respectively, corresponding to residues 127-368 and 294-368 (full length sigma 70 = 368 AA), the full-length sigma 70 and the two fragments interacting with ORF No. 67 from *S. aureus* phage C1.

10. The above identified bacteriophage fragments and bacterial fragments were identified using routine procedures as described in the application, namely by deletion analysis using PCR methodologies and measurement of protein:protein interaction using a yeast two-hybrid assay or an inducible cell expression system.

11. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States

Atty. Dkt. No. 073406-0410

Code and that such willful false statements may jeopardize the validity of the application or any patent resulting therefrom.

Date: 05/04/03

Michael A. Dubow  
Dr. Michael Dubow

Encl. Annex 1: CV of Dr Michael Dubow

**Dr. MICHAEL S. DUBOW**

**ADDRESS:**

April 9, 2003

**Home**

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Antony, France  
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**Office**

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E-Mail: michael.dubow@igmors.u-psud.fr

**Birth:** May 29, 1950

**Citizenship:** Citizen of U.S.A.; Canada

**Languages:** English, French

**EDUCATION**

College:	SUNY Binghamton	B.Sc. (Biology)	1972
University:	Indiana University	M.A. (Microbiology)	1975
	Indiana University	Ph.D. (Microbiology)	1977

**PROFESSIONAL HISTORY**

**Université de Paris-Sud**, Institut de Génétique et Microbiologie, France, 2002-present

Professor (2002-present)

**McGill University**, Department of Microbiology & Immunology, Montreal, PQ., Canada, 1980 - 2002

Professor (1991-2002)

Professor and Chair (1994-1999)

Invited Professor, University of Copenhagen, Denmark (December, 1995)

Invited Professor, Université Paris XI - Orsay, France (June, 1995)

Invited Professor, Université de Metz, France (June, 1994)

Professor (1991-1994)

Professor - Department of Human Genetics (1991-Present)

Appointed Research Scholar (Exceptional Merit) of the Fonds de la Recherche en Santé du Québec (1989-1994).

Associate Professor - McGill Centre for Human Genetics (1987-1990).

Associate Professor (1986-1990).

Appointed Research Scholar (Senior I) of the Fonds de la Recherche en Santé du Québec (1986-1989).

Appointed Scholar of the Medical Research Council of Canada (1981-1986).

Assistant Professor (1980-1986).

Cold Spring Harbor Laboratory, Cold Spring Harbor, New York, U.S.A. April, 1977-June, 1980.

Postdoctoral Research Fellow - Molecular Genetics Laboratory of the late Dr. Ahmad I. Bukhari.

Indiana University, Bloomington, Indiana, U.S.A. August, 1972-February, 1977

Ph.D. Dissertation: The Functions and Distribution Among Procaryotes of Host Factor for Coliphage Q $\beta$  RNA Replication. Advisor: Dr. Thomas Blumenthal.

SUNY Binghamton, Binghamton, New York, U.S.A. September, 1968-May, 1972.

Senior Independent Research under the supervision of the late Dr. Mildred Schellig-Hackett.

Midwood High School, Brooklyn, New York. September, 1965-May, 1968.

Chief Student Assistant to the Biology Department Laboratory.

Recipient of the 'Laboratory Techniques Award' and the 'Annette R. Brody Biology Service Award'.

### **SCHOLARLY AWARDS**

New York State Regents Scholarship	1968-1972
New York State Scholar Incentive Award	1968-1972
Indiana University Fellowship	1972-1973
Floyd Memorial Fellowship	1973-1974
NIH Genetics Training Grant	1974-1977
NIH-SUNY Viral Oncology Fellowship	1977-1979
MRC Scholarship	1981-1986
Research Scholar (Senior I) of the FRSQ	1986-1989
Research Scholar (Exceptional Merit) of the FRSQ	1989-1994

### **SCHOLARLY HONOURS**

Honor Roll, Dean's List	1969,1970,1972
Selected for Practicum in Teaching College Biology	1971-1972
Garner Award - American Society for Microbiology	1975
Beckman Prize for Innovative Research In Toxicity Assessment Using Microorganisms	1983
Ciba-Geigy Proze (with Mrs. Heather Borthwick-Hoff)	1984
FRSQ Prize for Excellence (with Mrs. Annie Kupelian)	1987
Fisher Scientific Award of the Canadian Society of Microbiologists	1988
Fellow-American Academy of Microbiology	1994-present
Foundation for Microbiology Lecturer (American Society for Microbiology)	1994-1996
Leo Yaffe Award - Outstanding Teacher of the Faculty of Science (McGill)	1994
FRSQ Prize for Excellence (with M.C. Karatzios)	1995
Wellcome Visiting Professor in the Microbiological Sciences	1999-2000

**MEMBERSHIP ON GRANTS PANELS**

Member of Grants Panel - Natural Sciences and Engineering Research Council - Strategic Grants (Environmental Toxicology); 1987-1988; Chair (Environmental Quality) - 1989.

Member of Grants Panel - United States Environmental Protection Agency; a) Air and Water Quality, b) Superfund, c) Centres of Excellence; 1987 - 1992.

Member of Medical Advisory Board - Cancer Research Society; 1987, 1988.

Member of Grants Panel - Medical Research Council of Canada - Microbiology and Infectious Diseases; 1988-1991.

Member of Grants Panel - Natural Sciences and Engineering Research Council - NSERC/Environment Canada Targeted Research (Centre St. Laurent); 1990 - 1992.

Chair of Grants Panel - Fonds de la Recherche en Santé du Québec - Hydro Québec/FRSQ; Réseau du Génétique Appliquée Humaine; 1993; 1996.

Member of Grants Panel - Natural Sciences and Engineering Research Council - Operating Grants (GSC33: Molecular and Developmental Genetics); 1994 - 1997.

**PROFESSIONAL SOCIETIES**

American Society for Microbiology  
Genetics Society of Canada  
Canadian Society of Microbiologists

**COMMITTEE PARTICIPATION**

Chair, Curriculum Planning Committee	1984-1992
Science Undergraduate Committee	1980-1981, 1983-Present
Graduate Committee	1981-1983, 1985-1993 (Chair), 1986-1987; 1990-1993; 1994-Present)
Fellowships Committee	1981-1983, 1994-Present
Physical Planning Advisory Committee	1982-1983
Safety Committee	1983-1992
Library Committee	1983-1984
Seminar Committee	1986-1988; 1993-Present
Council of the Graduate Faculty (McGill)	1982-1985, 1993
Genetic Engineering and Biotechnology Committee (Genetics Society of Canada)	1982-1985
Education Committee (Canadian Society of Microbiology)	1983-1986
Membership Committee (Canadian Society of Microbiologists)	1986-1988
Awards Committee (Canadian Society of Microbiologists)	1991-1994 1994-1995(Chair)

McGill Faculty of Medicine Scholarships Committee	1987-1990
Biotechnology Advisory Committee (McGill)	1988-1991
Section of "Genetics and Molecular Biology" -	1988-1990 (Vice Chair)
Canadian Society of Microbiologists	1990-1992 (Chair)
Elected Senator (Faculty of Science) to McGill Senate	1988-1989
Elected Senator (Faculty of Medicine) to McGill Senate	1989-1997
a) Steering Committee	1989-1997
b) Nominating Committee	1989-1997

### **RESEARCH SUPPORT (Direct Costs)**

1. Medical Research Council of Canada – Studies on Transposable Phages Mu, D108 and D3112. Principal Investigator 1981-2000. \$1,398,800.00.
2. National Cancer Institute of Canada – Biochemical Studies on Viral DNA Integrative Replication and Maturation. Principal Investigator 1981-1986. \$172,525.00.
3. Faculty of Graduate Studies and Research – Research Equipment grant. Principal Investigator 1981. \$7,243.00.
4. Fonds de la Recherche en Santé du Québec -- Réplication-Integrative (Transposition) du Génome du Bactériophage Mu. Principal Investigator 1981-1983. \$15,000.00.
5. Natural Sciences and Engineering Research Council (Strategic) –The Effect of Genotoxic Agents on Movable Genetic Elements. Principal Investigator 1982-1985. \$201,700.00.
6. Medical Research Council of Canada – Outright Grant for Scholarship. Principal Investigator 1981-1986. \$10,000.00.
7. Natural Sciences and Engineering Research Council (Strategic) –Infectivity Genes of *Rhizobium* and their Relationship with Other Phytopathogenic Bacteria. Co-Principal Investigator (with Drs. Brown, Bussey and Verma) 1982-1985. \$192,000.00.
8. Natural Sciences and Engineering Research Council (Strategic) – The Construction of Unique Biosensors for the Detection of Toxic Agents. Principal Investigator 1985-1988. \$155,766.00.
9. Natural Sciences and Engineering Research Council (Operating) – Identification and Characterization of New Genetic Responses in *Escherichia coli* and Human (Hela) Cells. Principal Investigator 1986-2002. \$393,660.
10. Agriculture Canada – The Construction of Unique Biosensors for the Detection of Toxic or Stressful Agricultural Agents. Principal Investigator 1986-89. \$30,000.00.
11. Natural Sciences and Engineering Research Council (Strategic) – Unique Gene - Fusion Biosensors to Detect Toxic Agents and Characterize Their Mechanisms of Toxicity. Principal Investigator 1988-1991. \$206,100.00.

12. Environment Canada/Natural Sciences and Engineering Research Council (Joint Subvention) – Genetically Engineered Living Biosensors as Stress Indicators for Aquatic Ecosystems. Principal Investigator 1990-1993. \$144,000.00.
13. The Council for Tobacco Research USA Inc. -- Molecular Mechanisms of Aluminum, Arsenic and Nickel Toxicity. 1992-1995. \$210,000.00 (U.S.).
14. The Center for Alternatives to Animal Testing, USA -- Cellular-Based Assays to Detect Toxic Agents and Elucidate the Underlying Genetic and Biochemical Mechanisms of Toxicity. Principal Investigator 1994-1998. \$60,000.00 (U.S.)
15. Department of Fisheries and Oceans (Canada)/Natural Sciences and Engineering Research Council (Canada) – Biotechnology to Detect and Characterize Organic Environmental Hazards in Aquatic Ecosystems. Principal Investigator 1994-96. \$30,000.00.

#### Major Equipment Grants

- a) Medical Research Council of Canada (1981) – \$36,500.00. with Drs. Acheson and Hassell.
- b) National Cancer Institute of Canada (1981) – \$87,794.00. with Drs. Acheson and Hassell.
- c) Medical Research Council of Canada (1983) – \$15,600.00. with Drs. Acheson, Briedis and Hassell.
- d) Medical Research Council of Canada (1985) – \$27,000.00. with Drs. Acheson, Briedis and Hassell.
- e) Medical Research Council of Canada (1992) – \$72,000.00. with Drs. Acheson, Briedis, and Cochrane.

Note: Grants 1 and 9 are currently operating.

#### **BOOKS**

1. Bacteriophage Assembly. Michael S. DuBow, Editor. © 1981, Alan R. Liss Inc., New York, 554 pp.
2. Viruses of Procaryotes. Hans W. Ackermann and Michael S. DuBow, © 1987, CRC Press.  
Volume 1: 202 pp.  
Volume 2: 242 pp.

#### **PUBLICATIONS**

1. DuBow, M.S. and Blumenthal, T. Host Factor for Coliphage Q $\beta$  RNA Replication is Present in *Pseudomonasputida*. *Molecular and General Genetics* 141: 113-119 (1975).
2. DuBow, M.S., Ryan, T., Young, R.A. and Blumenthal, T., Host Factor for Coliphage Q $\beta$  RNA Replication: Presence in Procaryotes and Association with the 30S Subunit in *Escherichia coli*. *Molecular and General Genetics* 153: 39-43 (1977).
3. DuBow, M.S. and Ryan, T., Host Factor for Coliphage Q $\beta$  RNA Replication as an Aid in Elucidating Phylogenetic Relationships: The Genus *Pseudomonas*. *Journal of General Microbiology* 102: 263-268 (1977).
4. Ljungquist, E., Khatoon, H., DuBow, M.S., Ambrosio, L., DeBruijn, F. and Bukhari, A.I., Integration of Bacteriophage Mu DNA. *Cold Spring Harbor Symp. Quant. Biol.* 43: 1151-1158 (1978).
5. Khatoon, H., Chaconas, G., DuBow, M.S. and Bukhari, A.I. The Mu Paradox: Excision Versus Replication. In: *The Eighth Annual ICN-UCLA Symposia-Extrachromosomal DNA*. Academic Press, N.Y., 1979, pp. 143-154.



6. DuBow, M.S. and Bukhari, A.I. Effects of Prophage Mu Induction on Expression of Adjacent Host Genes. *Mol. Biol. Rep.* 6: 229-234 (1980).
7. Chaconas, G., Harshey, R.M., DuBow, M.S., Sarvetnick, N. and Bukhari, A.I., Transposable Genetic Elements: The Mu Paradigm. In: Miami Winter Symposium 1980-Mobilization and Reassembly of Genetic Information. Academic Press, N.Y., 1980. pp. 81-91.
8. DuBow, M.S. and Bukhari, A.I., The Proteins of Bacteriophage Mu: Composition of the Virion and Biosynthesis *in vivo* During Lytic Growth. In: Bacteriophage Assembly. DuBow, M.S. Editor. Alan R. Liss Inc., N.Y. 1981. pp. 47-67.
9. Chaconas, G., deBruijn, F., Casadaban, M.J., Lupski, J.R., Kwoh, T.J., Harshey, R.M., DuBow, M.S. and Bukhari, A.I., *In vitro* and *in vivo* Manipulations of Bacteriophage Mu DNA: Cloning of Mu Ends and Construction of Mini-Mu's Carrying Selectable Markers. *Gene* 13: 37-46 (1981).
10. Coulton, J.W., Mason, P. and DuBow, M.S., Molecular Cloning of the Ferrichrome-Iron Receptor of *Escherichia coli* K12. *Journal of Bacteriology* 156: 1315-1321 (1983).
11. Shinder, G., Tourjman, S. and DuBow, M.S., Bacteriophage Mu DNA Transposition to Identify New Classes of Genotoxic Agents. In: Toxicity Screening Procedures Using Bacterial Systems. Liu, D. and Dutka, B.J. (eds.). Marcel Dekker Inc., N.Y. pp. 295-308 (1984).
12. DuBow, M.S. and Bukhari, A.I. Regulation of Bacteriophage Mu and Mini-Mu DNA Replication *in vivo*. *Biochem. Intl.* 10: 945-953 (1985).
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#### **CONFERENCE PRESENTATIONS AND PROCEEDINGS**

1. DuBow, M.S. and Blumenthal, T. Coliphage Q $\beta$  Host Factor. Yearly Meeting of the Indiana Branch of the American Society for Microbiology (1975) (**GARNER AWARD**).
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9. DuBow, M.S., Evans, D., Sarvetnick, N. and Bukhari, A.I. Utilization of  $\beta$ -lactamase as a measure of amp<sup>r</sup>-encoding DNA replication. Cold Spring Harbor Bacteriophage Meeting (1979).
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13. Giroux, H., Tolias, P. and DuBow, M.S. Characterization of bacteriophage Mu DNA-binding proteins. EMBO Workshop-Bacteriophage Mu: The Netherlands (1981).
14. **Organizer and Keynote Speaker-** "Genome Structure and Rearrangements" Symposium for the Annual Meeting of the Canadian Society of Microbiologists (1982).
15. Szatmari, G., Harel, J., Herbert, R., Tolias, P., Levin, D., Kahn, J., and DuBow, M.S. Analysis of bacteriophages Mu and D108 DNA transposition and maturation. Annual Meeting of the Canadian Society of Microbiologists (1982).
16. DuBow, M.S., Herbert, R., Levin, D., Harel, J., Szatmari, G., Tolias, P. and Kahn, J. Biochemical investigations of bacteriophages Mu and D108 DNA transposition. XIII International Congress of Microbiology - Boston, MA (1982).
17. Harel, J., Tolias, P., Herbert, R., Szatmari, G., Kahn, J., and DuBow, M.S. Genetic and Biochemical investigations of DNA transposition. Symposium on Gene Structure and Gene Expression (Canadian Biochemical Society) (1982).
18. Szatmari, G., Harel, J., Herbert, R., Tolias, P., Levin, D. and DuBow, M.S. Biochemical analysis of bacteriophages Mu and D108 DNA transposition. American Society for Virology (1982).
19. Shinder, G., Tourjman, S. and DuBow, M.S. Bacteriophage Mu DNA transposition to identify new classes of genotoxic agents. International Symposium on Toxicity Testing Using Bacteria (1983).  
**AWARDED BECKMAN PRIZE FOR MOST INNOVATIVE RESEARCH.**
20. DuBow, M.S. and Shinder, G. The response of transposable genetic elements to genotoxic agents. UCLA Symposium (Mechanisms of DNA Replication and Recombination) - Keystone, Colorado (1983).
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26. Szatmari, G.B., Kahn, J.S. and DuBow, M.S. Characterization of bacteriophage Mu and D108 insertions in pSC101. Molecular Genetics of Bacteria and Phage - Cold Spring Harbor (1985).
27. Tolias, P.P. and DuBow, M.S. Cloning and characterization of the bacteriophages Mu and D108 DNA-binding regulatory protein Ner. Molecular Genetics of Bacteria and Phage - Cold Spring Harbor (1985).
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48. **Invited Speaker** - "Caracterization Moleculaire des Mutations Spontanees Portant sur un Gene (Thymidine Kinase du Virus HVS-1) dans un Contexte Chromosomique". XXXe Réunion Annuelle du Club de Recherches Clinique du Québec - Pointe-au-Pic, Québec (1988).
49. Sol, K. and DuBow, M.S. Isolation and characterization of human repetitive satellite DNA. Joint Meeting - American Society for Cell Biology and American Society for Biochemistry and Molecular Biology - San Francisco, CA (1989).
50. Kukolj, G. and DuBow, M.S. DNA-directed oligomerization of the monomeric Ner repressors from bacteriophages Mu and D108. UCLA Symposium on Molecular Mechanisms in DNA Replication and Recombination - Keystone, Colorado (1989).
51. Guzzo, A., Marmor, J., Shinder, R. and DuBow, M.S. The use of gene fusions to detect toxic agents and elucidate molecular mechanisms of toxicity. International Symposium on Toxicity Assessment - Las Vegas, Nevada (1989).

52. **Invited Speaker** - "Protein-DNA interactions that govern the regulation of coliphages Mu and D108 genome transcription" - Annual Meeting of the Canadian Society of Microbiologists - Laval, Quebec (1989).
53. Boismenu, R., van Oers, N.S.C., DuBow, M.S., Bérubé, G., Murgita, R.A. Expression of a full-length cDNA for mouse alpha-fetoprotein in *Escherichia coli*. 7th International Congress of Immunology. Berlin, Federal Republic of Germany (1989).
54. Guzzo, A. and DuBow, M.S. The use of *E. coli* *Lux A*, *B* gene fusions to detect toxic agents and dissect molecular mechanisms of toxicity. Society of Environment Toxicology and Chemistry Northeastern North America Chapter Meeting - Mt. St.-Hilaire, Quebec (1990).
55. Marmor, J., Shinder, R. and DuBow, M.S. The use of *lac Z* gene fusions to detect a novel *E. coli* operon which responds to bioavailable amounts of arsenic and antimony. Society of Environmental Toxicology and Chemistry Northeastern North America Chapter Meeting - Mt. St.-Hilaire, Quebec (1990).
56. DuBow, M.S. Autexier, C., Cameron, R., Kukolj, G., Ulyczynj, P. and Wragg-Légaré, S. The evolution of the protein-DNA interactions that regulate and catalyze the transposition of coliphages Mu and D108. VIII International Congress of Virology - Berlin, Federal Republic of Germany (1990).
57. Autexier, C., Wragg-Légaré, S. and DuBow, M.S. Regulation of gene expression in transposable coliphages Mu and D108, and *Pseudomonas* phage D3112. EMBO Workshop on Molecular Mechanisms of Transposition and its Control - Roscoff, France (1990).
58. DuBow, M.S., Shinder, R. and Marmor, J. The use of *lac Z* gene fusions to detect a novel *E. coli* operon which responds to bioavailable amounts of arsenic and antimony. Canadian Association on Water Pollution Research and Control - Montreal, Quebec (1990).
59. Guzzo, A. and DuBow, M.S. The use of luciferase gene fusions to monitor toxic metals in aquatic environments and elucidate their molecular mechanisms of toxicity. Canadian Association on Water Pollution Research and Control - Montreal, Quebec (1990).
60. Cameron, R. and DuBow, M.S. The Mu transposase protein can transpose the ends of the class II elements Tn3 and IS101 *in vivo*. Workshop on Site-specific Recombination and Transposition - Woods Hole, Massachusetts (1990).
61. DuBow, M.S., Shinder, R., and Marmor, J.S. The use of *Lac Z* gene fusions to detect a novel *E. coli* operon which responds to bioavailable amounts of arsenic and antimony. International Symposium on Toxicity Assessment - Kurashiki, Japan (1991).
62. Guzzo, A. and DuBow, M.S. Use of luciferase gene fusions for short-term assays to monitor toxic metals in the environment and elucidate their molecular mechanisms of toxicity. International Symposium on Toxicity Assessment - Kurashiki, Japan (1991).
63. DuBow, M.S., Sieder, F., Siboo, I., Chan, H.L.B., Burns, C., and Barlas, G. *In vitro* maturation and encapsidation of transposable coliphages Mu and D108 DNA's. XII International Conference on Bacteriophage Assembly - Cable, Wisconsin (1991).
64. Brisebois, J. and DuBow, M.S. Molecular characterization of spontaneous null mutations in a human chromosomally-integrated, single copy HSV-1 *tk* gene. VI International Congress of Human Genetics - Washington, D.C. (1991).

65. **Invited Speaker** - "Control of the recombination pathways (transposition and maturation) of transposable coliphages Mu and D108 DNA's" - Annual Meeting of the Canadian Society of Microbiologists - St. John's, Newfoundland (1992).
66. DuBow, M.S., Guzzo, A., Briscoe, C., Cai, J. and Diorio, C. Living bioluminescent biosensors for the detection of toxic agents and elucidation of their mechanisms of toxicity. VI International Congress of Toxicology - Rome, Italy (1992).
67. Kukolj, G. and DuBow, M.S. Control of D108 transposase gene expression: DNA structural alterations in the left-end regulatory region. Keystone Symposium on Molecular Mechanisms in DNA Replication and Recombination - Taos, New Mexico (1992).
68. Cai, J., Diorio, C. and DuBow, M.S. Cloning, sequencing and characterization of an arsenic/antimony responding gene in gram-negative bacteria. Annual Meeting of the Society of Environmental Toxicology and Chemistry - Cincinnati, Ohio (1992).
69. Guzzo, A. and DuBow, M.S. Luminescent biosensors for biomonitoring of aluminum and nickel and for the elucidation of their genetic mechanisms of toxicity. Annual Meeting of the Society of Environmental Toxicology and Chemistry - Cincinnati, Ohio (1992).  
**WINNER OF THE SETAC - BATELLE AWARD FOR BEST STUDENT PRESENTATION.**
70. Briscoe, S. F. and DuBow, M.S. Use of an *E. coli luxA,B* gene fusion library to elucidate molecular mechanisms of genetic responses to common organic compounds. Annual Meeting of the Society of Environmental Toxicology and Chemistry - Cincinnati, Ohio (1992).
71. MacIntyre, G., Lemieux, J. and DuBow, M.S. The Ner/Nep/TMF family of DNA allosteric binding/regulatory proteins. Keystone Symposium on Bacterial Chromosomes - Keystone, Colorado (1993).
72. DuBow, M.S., Guzzo, A., Briscoe, S.F., Cai, J. and Diorio, C. Bacterial biosensors for monitoring aluminum, arsenic and nickel and elucidation of their genetic mechanisms of toxicity. FEMS Symposium on Metal Microorganism Relationships and Applications - Metz, France (1993).
73. MacIntyre, G., Lemieux, J. and DuBow, M.S. The lytic/lysogenic decision of transposable coliphages Mu and D108. IX International Congress of Virology - Glasgow, Scotland (1993).
74. DuBow, M.S., Lemieux, J. and MacIntyre, G. The Ner/Nlp/TMF family of gene regulatory proteins. IX International Congress of Virology - Glasgow, Scotland (1993).
75. Siboo, I., Sieder, F. and DuBow, M.S. Maturation and encapsidation of the DNA from transposable coliphages Mu and D108. XIII International Conference on Virus and Phage Assembly - Syria, Virginia (1993).
76. Blaise, C., Forghani, R., Guzzo, J. and DuBow, M.S. A novel Microtox assay performed with microplates and microluminometry. VI International Symposium on Toxicity Assessment and On-line Monitoring - Berlin, Germany (1993).
77. MacIntyre, G. and DuBow, M.S. Involvement of the Ner/Nlp/TMF family of DNA-binding proteins in Crp-regulated genes. XVII International Congress of Genetics - Birmingham, U.K. (1993).
78. Brisebois, J.J. and DuBow, M.S. Molecular characterization of spontaneous null mutations in a chromosomally-integrated, single copy, HSV-1 *tk* gene. XVII International Congress of Genetics - Birmingham, U.K. (1993).

79. Ulyczynj, P. and DuBow, M.S. Characterization of the bacteriophages Mu and D3112 transposase proteins. Annual Meeting of the American Society for Microbiology - Atlanta, Georgia (1993).
80. Guzzo, J., Diorio, C., Guzzo, A. and DuBow, M.S. Identification of genetically-programmed responses to selenium exposure in *Escherichia coli*. 7th International Symposium on the Genetics of Industrial Microorganisms - Montréal, Québec (1994).
81. Ulyczynj, P., Salmon, K. and DuBow, M.S. Characterization of the transposition and regulatory functions of the transposable *Pseudomonas* bacteriophage D3112. 7th International Symposium on the Genetics of Industrial Microorganisms - Montréal, Québec (1994).
82. Cai, J., Guzzo, A. and DuBow, M. S. Luciferase gene fusions to identify genetically-programmed responses to toxic agent exposure in *Escherichia coli*. Workshop on Plasmid Diversity - Montréal, Québec (1994).
83. Briscoe, S. and DuBow, M.S. Luminescent biosensors for the detection of organonitrogen compounds and the elucidation of their mechanisms of toxicity. International Symposium on Environmental Biotechnology - Waterloo, Ontario (1994).
84. Blaise, C., Forghani, R., Legault, R., Guzzo, J. and DuBow, M.S. A bacterial toxicity assay performed with microplates, microluminometry, and Microtox reagent. 21st Annual Aquatic Toxicity Workshop - Sarnia, Ontario (1994).
85. Salmon, K.A., Ulyczynj, P.I. and DuBow, M.S. Characterization of the repressor (c) and transposase (A) proteins of the *Pseudomonas aeruginosa* transposable bacteriophage D3112. American Society for Microbiology, 95th General Meeting, Washington D.C., USA (1995).
86. Macintyre, G., Thiam, M., Paterson, L. and DuBow, M.S. The role of the Ner/Nlp/TMF DNA binding protein family in gene expression and genome structure. American Society for Microbiology, 95th General Meeting, Washington D.C., USA (1995).
87. Siboo, I., Sieder, F. and DuBow, M.S. Isolation and characterization of the morphogenetic precursors of transposable phages Mu and D108. American Society for Microbiology, 95th General Meeting, Washington D.C., USA (1995).
88. Guzzo, J., Diorio, C., Guzzo, A., and DuBow, M.S. Luciferase gene fusions identify two new selenium-inducible genes in *Escherichia coli*. 45<sup>th</sup> Annual Meeting of the Canadian Society of Microbiologists, Kingston, Ontario, Canada (1995).
89. Paterson, L., Macintyre, G., Thiam, M., Sequin, B., Fortin, D., and DuBow, M.S. The functional characterization of the Ner/Nlp/TMF family of DNA binding proteins. 45<sup>th</sup> Annual Meeting of the Canadian Society of Microbiologists, Kingston, Ontario, Canada (1995).
90. **Invited Speaker** - Blazing Biosensors: Their use in the identification of genes that respond to toxic environmental pollutants. Foundation for Microbiology Lecturer of the American Society for Microbiology, North Central Branch Annual Meeting, University of Iowa, Iowa City, USA (1995).
91. Guzzo, J., and DuBow, M.S. Identification of selenium-inducible genes in *Escherichia coli*. 9<sup>th</sup> Annual Environmental Sciences and Engineering Research Conference, Gananoque, Ontario, Canada (1995).
92. **Invited Speaker** - Blazing Biosensors: Their extreme sensitivity and biological relevance. The Ecotox Workshop, Winnipeg, Manitoba (1996).

93. **Invited Speaker** - Blazing Biosensors: Their use in the identification of genes that respond to toxic agents. Foundation for Microbiology Lecturer of the American Society for Microbiology, Annual Meeting of the American Association for Clinical Chemistry, Chicago, Illinois, USA (1996).
94. Siboo, I.R., Sieder, F. and DuBow, M.S. Characterization of the function(s) of purified morphogenetic precursors of the transposable bacteriophages Mu and D108. 96<sup>th</sup> Annual Meeting of the American Society for Microbiology, New Orleans, Louisiana, USA (1996).
95. Paterson, L., Macintyre, G., Sequin, B., Thiam, M., and DuBow, M.S. Regulation of gene expression by a member of the Ner/Nlp/TMF DNA-binding protein family. 96<sup>th</sup> Annual Meeting of the American Society for Microbiology, New Orleans, Louisiana, USA (1996).
96. Cai, J. and DuBow, M.S. Luminescent bacterial biosensors for characterizing genetically-programmed responses to arsenic and biomonitoring of arsenic toxicity. The International Society for Environmental Biotechnology, Third International Symposium - Boston, MA, USA (1996).
97. Alexander, D., Briscoe, S., Cai, J., Costanzo, M., Diorio, C., Fortin, D., Guzzo, J., Salmon, K. and DuBow, M.S. New strategies and targets for the detection and eradication of bacteria. 2<sup>nd</sup> World Congress on Cellular and Molecular Biology, Ottawa (1996).
98. **Symposium Organizer and Keynote Speaker** - Alexander, D., Briscoe, S., Cai, J., Diorio, C., Guzzo, J. and DuBow, M.S. Living, luminescent biosensors to detect and characterize genetically-programmed stress responses to environmental pollutants. International Congress of Stress, Budapest, Hungary (1997).
99. Saint-Dic, D., and DuBow, M.S. Effect of cis-located human staeellite DNA on expression of electroporated genes. 97<sup>th</sup> Annual Meeting of the American Society for Microbiology, Miami Beach, Florida, USA (1997).
100. Salmon, K.A., and DuBow, M.S. Promotor studies of the repressor (*c*) and transposase (*A*) genes of the *Pseudomonas aeruginosa* transposable bacteriophage D3112. American Society for Microbiology. 97<sup>th</sup> General Meeting, Miami Beach, Florida, USA (1997).
101. Siboo, I.R., Sieder, F. and DuBow, M.S. Characterization of capsids and DNA packaging of the transposable coliphages Mu and D108. The XVth International Phage/Virus Assembly Conference, Asilomar, California (1997).
102. **Invited Speaker** - DuBow, M.S., Fortin, D., Paterson, L. and Thiam, M. Analysis of the Ner/Nlp/TMF DNA-binding protein family. EMBO WORKSHOP - "Nature and Nurture in Bacterial Evolution". Les Houches, France (1997).
103. Saint-Dic, D., and DuBow, M.S. Effect of *cis*-located human satellite DNA on expression of electroporated genes. 41<sup>st</sup> Annual Meeting, Canadian Federation of Biological Societies, Edmonton, Alberta, Canada (1998) **GENETICS SOCIETY OF CANADA STUDENT POSTER COMPETITION WINNER.**
104. **Invited Speaker** - Alexander, D., Cai, J., Diorio, C., Guzzo, J., and DuBow, M.S. Luminescent gene fusion biosensors to detect and characterize genetically programmed responses to environmental stress in bacteria. 8<sup>th</sup> International Symposium on Microbial Ecology, Halifax, Nova Scotia, Canada (1998).
105. **Invited Speaker** - Alexander, D., Briscoe, S, Cai, J., Chaorensri, C., Diorio, C., Guzzo, J., DuBow, M.S. The Construction and use of living, luminescent gene-fusion biosensors for determining water quality at

the biological and chemical levels. Environmental Challenges for the Next Millenium, Jerusalem, Israel (1999).

### **CONTRIBUTIONS TO TEACHING**

#### **1980-1981**

528-704A Moveable Genetic Elements; Course Coordinator

528-324A Fundamental Virology

528-211A Introductory Microbiology

#### **1981-1982**

528-704A Moveable Genetic Elements; Course Coordinator

528-324A Fundamental Virology

528-211A Introductory Microbiology

Infectious Diseases Residents Basic Science Seminar - Mechanism of the Spread of Antibiotic Resistance

**Departmental Outstanding Teacher**

#### **1982-1983**

528-324A Fundamental Virology

528-211A Introductory Microbiology

528-702B Graduate Seminar

#### **1983-1984**

528-502D Undergraduate Honors Research; Course Coordinator

528-324A Fundamental Virology

528-211A Introductory Microbiology

170-302B Laboratory in Molecular Biology - Developed and taught new laboratory sections in biotechnology. (Department of Biology).

SMC6040 (516-604D) Biologie Cellulaire (Cellular Biology) - Université de Montréal.

#### **1984-1985**

U1 Students' Advisor

528-502D Undergraduate Honors Research; Course Coordinator

528-324A Fundamental Virology

528-211A Introductory Microbiology

177-302B Laboratory in Molecular Biology (Department of Biology)

SMC 6040 (516-604D) Biologie Cellulaire (Cellular Biology) - Université de Montréal

528-702B Genetic Recombination

1985-1986

U2 Students Advisor

528-386B Designed and coordinate a new laboratory course entitled "Techniques in Molecular Cloning" - *This course teaches the newest techniques in environmental biotechnology including gene cloning, sequencing, expression, and protein engineering.*

528-502D Undergraduate Honors Research; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

177-302B Laboratory in Molecular Biology. (Department of Biology).

1986-1987

U3 Students Advisor

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-502D Undergraduate Honors Research; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

177-302B Laboratory in Molecular Biology (Department of Biology)

528-704B Genetic Recombination; Course Coordinator

**Departmental Outstanding Teacher**

1987-1988

Chief Undergraduate Advisor

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-502D Undergraduate Honors Research; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

177-302B Laboratory in Molecular Biology (Department of Biology)

**Departmental Outstanding Teacher**

1988-1989

U1 Undergraduate Advisor

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-502D Undergraduate Honors Research; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

SMC 6040 (516-604D) Biologie Cellulaire (Cellular Biology) - Université de Montréal.

**Departmental Outstanding Teacher**

1989-1990

U2 Undergraduate Advisor

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-502D Undergraduate Honors Research; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

202-505B Biotechnology

**Departmental Outstanding Teacher**

1990-1991

U3 Undergraduate Advisor.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

202-505B Biotechnology

**Departmental Outstanding Teacher**

1991-1992

U1 Undergraduate Advisor.

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

202-505B Biotechnology

528-703A The Evolution of Gene Structure and Function

**Departmental Outstanding Teacher**

1992-1993

U2 Undergraduate Advisor.

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

202-505B Biotechnology.

**Departmental Outstanding Teacher**



1993-1994

U3 Undergraduate Advisor.

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

**Departmental Outstanding Teacher**

**Recipient of the Leo Yaffe Award as Outstanding Teacher of the Faculty of Science.**

1994-1995

U1 Undergraduate Advisor.

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

1995-1996

Chief Undergraduate Advisor.

528-386B Techniques in Molecular Cloning; Course Coordinator.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

524-207M Host Defence and Host/Parasite Relationship course (Unit 7)

**Departmental Outstanding Teacher**

1996-1997

Chief Undergraduate Advisor.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

1997-1998

Chief Undergraduate Advisor.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

528-387B Applied Microbiology and Immunology

1998-1999

Chief Undergraduate Advisor.

528-324A Fundamental Virology.

528-211A Introductory Microbiology.

528-387B Applied Microbiology and Immunology.

528-616A, 704A New Vistas in Microbial Ecology

**Departmental Outstanding Teacher**

**CONTRIBUTIONS TO THE DEPARTMENT AND THE UNIVERSITY****I. Masters (M.Sc.) Students Supervised**

Ms. Christina Zanfino (M.Sc. conferred Winter, 1983; cosupervisor with Dr. Jared Fein)

Thesis Title - "Investigations on the Role of *Escherichia coli* Fimbrial Adhesions in Urinary Tract Infections"

Ms. Daphne Goring (M.Sc. conferred Fall, 1985; NSERC Studentship)

Thesis Title - "The HSV-1 Thymidine Kinase Gene as a System to Analyze Chromosomal Mutations in a Human Cell Line"

Ms. Kalpana Gupta (M.Sc. conferred Fall, 1988; FRSQ Studentship)

Thesis Title - "Spontaneous Instabilities in a Chromosomally-Located HSV-1 *tk* Gene in a Transformed Human Cell Line"

Ms. Marina Pascali (M.Sc. conferred Fall, 1990; FCAR Studentship)

Thesis Title - "Techniques for Isolating Human Chromosomal DNA Surrounding an Integrated HSV-1 Thymidine Kinase Gene"

Mme. Stephanie Wragg-Légaré (M.Sc. conferred Spring, 1991; Cystic Fibrosis Foundation Studentship)

Thesis Title - "Characterization of the Regulatory Region of the Mu-like *Pseudomonas aeruginosa* Transposable Phage D3112"

Ms. Joy Marmor (M.Sc. conferred Fall, 1991; IRSST Studentship)

Thesis Title - "A Mud *Lac AMP* Transcriptional Fusion Identifies a Gene Induced by Arsenic and Antimony Salts"

Mme. Claire Fouquet - (NSERC Studentship) M.Sc. conferred Fall, 1992; recipient of W. Yaphe Award for Outstanding Departmental M.Sc. student (Academic year 1991-1992).

Thesis Title - "Satellite DNA and Electroporation Efficiency, Satellite DNA Binding-Proteins"

Mr. Jocelyn David (M.Sc. conferred Spring, 1994)

Thesis Title - "Characterization of the *nlp* Gene Family of the *Enterobacteriaceae*"

Ms. Lisa Paterson (M.Sc. conferred Spring, 1997)

Thesis Title - "*Escherichia coli* genes regulated by the transposable coliphage Ner-like protein - N1p"

Ms. Doris Fortin (Fisheries and Oceans Canada Studentship) (M.Sc. conferred Fall 1997).

Thesis Title - "Characterization of D108 Ner mutants and its *Escherichia coli* homologue, N1p"

Mr. Michael Constanzo (M.Sc. conferred Fall 1997)

Thesis Title - "Characterization and Use of Genetically-Programmed Responses to Chlordane, Dinoseb, Bromacil, and Arsenic Oxyanions "

Ms. Manuelle Rongy - current student.

Ms. Sarah Ferguson - current student

## **II. Doctoral (Ph.D.) Students Supervised**

Mme. Josée Harel (Canadian Cancer Society) - Degree conferred April, 1986; Postdoctoral Fellow - Stanford University; Currently - Associate Professor: Université de Montréal.

Thesis Title - "The *cis*-Required DNA Sequences for Bacteriophage Mu DNA Transposition and Maturation"

Mr. Peter Tolias (NSERC Studentship; MRC Studentship) - Recipient of W. Yaphe Award for Outstanding Departmental Ph.D. Student (Academic Year 1986-1987); Degree conferred April, 1987; Postdoctoral Fellow - Harvard University; Currently - Associate Member: Public Health Research Institute of New York.

Thesis Title - "Functional Protein-DNA Interactions of the Ner and Transposase Proteins from Bacteriophages Mu and D108"

Mr. George Szatmari (NSERC Studentship) - Outstanding Presentation Award: Canadian Genetics Society Annual Meeting (1984); Recipient of W. Yaphe Award for Outstanding Departmental Ph.D. Student (Academic Year 1987-1988); Degree conferred June 1987; Dean's Honor List; Postdoctoral Fellow - Institute of Genetics, University of Glasgow; Currently - Associate Professor: Université de Montréal.

Thesis Title - "Cloning and Characterization of Mu-like Transposable Bacteriophage D108"

Mr. David Levin (MRC Studentship) - Degree conferred October, 1987; Dean's Honor List; Postdoctoral Fellow - Biotechnology Research Institute (Montreal) and York University; Currently-Associate Professor, University of Victoria.

Thesis Title - "Characterization of the Repressor Gene Product (*c*) and the Immunity Region of Mu-like Transposable Bacteriophage D108"

Ms. Robin Cameron (Agriculture Canada Studentship; FCAR Studentship) - Degree conferred October, 1991; Postdoctoral Fellow: Scripps Institute and Noble Foundation; currently: Assistant Professor, University of Toronto.

Thesis Title - "Evolutionary Links Between Phages Mu, D108 and Transposons Tn3 and IS101"

Mlle. Chantal Autexier (NSERC Studentship; FRSQ Studentship) - Degree conferred November, 1991; Postdoctoral Fellow: Cold Spring Harbor Laboratory; currently - Assistant Professor, McGill University.

Thesis Title - "Characterization of the Ner/Nlp Family of DNA-Binding Regulatory Proteins"

Mme. Katherine Sol (WUSC Studentship) - Degree conferred April, 1992; Postdoctoral Fellow: Dupont-Merck Pharmaceuticals; currently - Research Associate: Dupont Children's Hospital, Wilmington, Delaware.

Thesis Title - "Isolation and Characterization of Human Highly Repeated Satellite II and III DNAs"

Mr. George Kukolj (FCAR Studentship) - Degree conferred April, 1992; Dean's Honor List; Recipient of W. Yaphe Award for Outstanding Departmental Ph.D. student (Academic Year 1991-1992); Postdoctoral Fellow: Fox Chase Institute for Cancer Research; currently - Senior Scientist -Bio-Mega/Boehringer Ingelheim Research Inc., Laval, Quebec.

Thesis Title - "Protein-DNA Interactions Regulating the Lytic/Lysogenic Switch in Transposable Mu-Like Bacteriophage D108"

Mlle. Josée Brisebois (NSERC Studentship; MRC Studentship; David M. Stewart Fellowship) - Degree conferred May, 1994; Postdoctoral Fellow: Bio-Mega/Boehringer Ingelheim Research Inc.; currently - Scientist: Merck Frosst Canada, Kirkland, Quebec.

Thesis Title - "Spontaneous Mutations in a Chromosomally - Integrated HSV-1 Thymidine Kinase Gene"

Ms. Angelina Guzzo (IRSST Studentship; NSERC Studentship; FRSQ Studentship) - Degree conferred February 1995; Dean's Honor List; Postdoctoral Fellow: Massachusetts Institute of Technology; currently - Medical student: McGill University.

Thesis Title - "Molecular Approaches to Identify Genetically Programmed Responses to Toxic Metal Exposure"

Mr. Peter Ulyczynj (FCAR Studentship) - Degree conferred June, 1995; currently Postdoctoral Fellow: Concordia University, Montreal, Quebec.

Thesis Title - "Characterization of the Transposases of Bacteriophages Mu and D3112"

Ms. Jie Cai - Degree conferred November, 1997; currently Postdoctoral Fellow: Department of Biochemistry, McGill University.

Thesis Title - "Identification and Characterization of a Chromosomal Arsenic/Antimony Inducible Operon in Gram-Negative Bacteria"

Mr. Ian Siboo (FCAR Studentship) - current student

Ms. Kirsty Salmon (NSERC Studentship) - current student

Mr. Scott Briscoe (Pestcon Studentship) - current student

Ms. Djennan St-Dic (FCAR Studentship) - current student

Ms. Julie Guzzo - current student

Mr. Madani Thiam - current student

Mr. David Alexander (MRC Studentship)- current student

Ms. Nicha Charoensri (Government of Thailand Studentship) - current student

### **III. Student Committees**

#### **A. Ph.D. Thesis/Defences**

Mr. Pierre Moreau (1980)

Mr. Leonard Neirink (1981)

Mr. Louis Dubeau (1981-Biochemistry)

Mr. Normand Brison (1982-Biology)

Mr. Helmut Zarble (1983-Biochemistry)

Mr. Luke Masson (1984)

Mr. Guy Theriault (Université Laval, Biochimie, 1985)

Mr. Brad Popovich (1986 - Human Genetics/Biology)

Mr. William Muller (1986)

Ms. Josée Harel (1986)

Mr. Peter Tolia (1987)

Mlle. Louise Poulin (1987 - Experimental Medicine)

Mr. George Szatmari (1987)

Mr. Richard Tseng (1987)

Mr. David Levin (1987)

Mr. Ghalib Alkhatib (1988)

Mr. Jerry Pelletier (1988 - Biochemistry)

Mr. Luc Villeneuve (1988 - Experimental Medicine)

Mr. Michael Boylan (1989 - Biochemistry)

Mr. Zafer Hatahet (1989 - Biochemistry)

Mr. William Sheffield (1989 - Biochemistry)

Mr. Paul Bentzen (1989 - Biology)

Mr. Steven Xanthoudakis (1990)

Vassiliki Koufopanou (1990 - Biology)

Peter Cserjesi (1991 - Biology)

Ronald Rooke (1991)

Hongskeng Su (1991 - Biology, Concordia University)

Daniel Sinnett (1991-Biochimie, Université de Montréal).

Robin Cameron (1991)

Chantal Autexier (1991)

Monique Lagacé (1991 - Biochemistry)

Mark Farinha (1991 - Microbiology and Immunology, Queens University)

Alan Davidson (1991 - Molecular and Medical Genetics, University of Toronto)

Lucie Cohen (1992)

Guy Czaika (1992 - Biochimie, Université de Montréal)

Michael MacAlear (1992 - Biochemistry)

Katia Sol (1992)

George Kukolj (1992)

Richard Boismenu (1992)

François Gauvin (1992 - Chemistry - **ProDean**)

Elana Swartzman (1992 - Biochemistry)

Cunle Wu (1992 - Experimental Medicine)

Luc Gaudreau (1993 - Biochimie, Université de Sherbrooke)

Romas Geleziunas (1993)

Doris Germain (1994 - Biochimie, Université de Montréal)

Arnim Peter Pause (1994 - Biochemistry)

Rachel Higgins (1994 - Medical Genetics, University of Toronto)

Josée Brisebois (1994)

Angelina Guzzo (1995)

Peter Ulyczynj (1995)

Pierre Lepage (1995 - Biochemistry)

Semyon Rubinchik (1995 - Molecular & Medical Genetics, University of Toronto)

Peter Liston (1995)

Ramakrishnan Srikumar (1996)

Paul White (1996 - Biology)

Clifford Zeyl (1996 - Biology)

Eric Massé (1996 - Microbiologie et Immunologie - Université Montréal)

Jose G. Teodoro (1996 - Biochemistry - **Pr Dean**)

Sylvain Coulombe (1997 - Chemical Engineering - **Pro-Dean**)

Nabeel Bardeesy (1998 - Biochemistry)

Graham Dellaire (1998 - Experimental Medicine)

Dominic Frigon (1999 - Biochemie - Université de Montréal)

Yu-Cai Peng (1999 - Deputy Chair)

**B. Summer Medical Bursary Students**

Ms. Smadar Tourjman (1981)

Mr. Dino Ramzi (1983)

Mr. David Hoff (1984)

Ms. Heather Borthwick-Hoff (1984) - Recipient of the Ciba-Geigy Award for Outstanding Summer Research.

Ms. Annie Kupelian (1987) - Recipient of the Prix d'Excellence of the FRSQ for Outstanding Summer Research.

Mr. Christos Karatzios (1995) - Recipient of the Prix d'Excellence of the FRSQ for Outstanding Summer Research.

Ms. Anne Chin (1996)

Ms. Sophie Kung (1996)

**C. Postdoctoral Fellows**

Dr. Margaret Durko: 1987-1989 (Cancer Research Society Postdoctoral Fellow)

Dr. Georgina Macintyre: 1991 - 1995

**D. Undergraduate Honors Research (528-502D)**

Mr. Peter Tolias (1980)

Mr. Jeffrey Kahn (1981)

Mr. Richard Herbert (1982)

Mr. Rowen Shinder (1983)

Ms. Anastasias Lyras (1983)

Ms. Annie Kupelian (1984)

Ms. Kelly Fox (1984)

Ms. Gayle Shinder (1984-Biochemistry)

Mr. Patrick Tremblay (1985)  
Ms. Carole Nadeau (1985)  
Mr. Allan Jarjour (1985)  
Mr. George Kukolj (1986)  
Mr. Peter Ulyczynj (1986)  
Mr. Alain Bigué (1987)  
Ms. Marina Pascali (1987)  
Ms. Angelina Guzzo (1988)  
Ms. Joy Marmor (1988)  
Ms. Stephanie Wragg-Légaré (1988)  
Ms. Lisa Ramshaw (1988)  
Mr. Chris Burns (1989)  
Ms. Laura Canby (1990)  
Ms. Miriam Bell (1990)  
Ms. Helen Chan (1990)  
Mr. George Barlas (1991)  
Mr. Felix Sieder (1991)  
Mr. Alfredo Staffa (1991)  
Mr. Jerry Zaharatos (1991)  
Ms. Kamini Milnes (1994)  
Mr. Christos Karatzios (1994)  
Ms. Doris Fortin (1995)  
Ms. Caroline Rochon (1996)  
Mr. Martin Richer (1996)  
Ms. Christine Lew (1997)  
Ms. Yan Yang (1998)



Ms. Orit Freedman (1998)

Ms. Nicola Matthews (1999)

Ms. Anne Mullin (1999)

**E. Doctoral Comprehensive Exams**

Mr. Charles Greer (1982)

Mr. Alain Nepveau (1982 - Microbiologie; Université de Sherbrooke)

Ms. Catherine Simonson (1982)

Mr. Peter Greer (1982-Biochemistry)

Mlle. Josée Harel (1983)

Ms. Jennifer Port (1983)

Mr. David Levin (1984)

Mr. Peter Talias (1984)

Mr. George Szatmari (1984)

Ms. Jacqueline Bergeron (1985)

Mlle. Katia Sol (1987)

Mlle. Linda Duplessis (1987)

Ms. Robin Cameron (1988)

Mlle. Chantal Autexier (1988)

Mr. George Kukolj (1989)

Mr. Peter Ulczynj (1989)

Mlle. Christiane Maroun (1989)

Mr. Ronald Rooke (1989)

Mlle. Lucie Cohen (1990)

Mlle. Josée Brisebois (1991)

Ms. Angelina Guzzo (1991)

Mr. Romas Geleziunas (1991)

Mr. Eustache Paramithiotis (1992)

Ms. Lori Haughn (1993)

Mr. Celestino DiFlumeri (1994)

Mr. Gregory Moeck (1994)

Mr. Scott Briscoe (1994)

Mr. Ian Siboo (1994)

Ms. Jie Cai (1995)

Mr. Hugo Soudeyns (1995)

Ms. Julie Guzzo (1996)

Ms. Kirsty Salmon (1996)

Ms. Djenann Saint-Dic (1996)

Mr. David Alexander (1997)

Mr. Madani Thiam (1997)

**F. NSERC Summer Undergraduate Research Fellowships**

Mr. Rowen Shinder (1982)

Ms. Annie Kupelian (1982,1983)

Ms. Gayle Shinder (1983)

Ms. Eunsil Kim (1984)

Mr. Alan Jarjour (1984, 1985)

Ms. Lalitha Mathai (1985)

Mr. Neil Shinder (1985, 1986)

Ms. Angelina Guzzo (1986)

Ms. Karen Reif (1986)

Mr. Deven Gujrathi (1987)

Ms. Anne Archambault (1988)

Ms. Laura-Ann Canby (1988; 1989)

Mr. Christopher Emanuel (1988)

Mr. Edward Raducanu (1988)

Ms. Helen Chan (1989)

Ms. Miriam Bell (1989)

Mr. Andrew Hyman (1989)

Mlle. Caroline Lafontaine (1989)

Mr. Ramin Mehin (1990)

Mr. Michael Tan (1990)

Mr. Felix Sieder (1990)

Mr. George Barlas (1990)

Mr. Jerry Zaharatos (1990)

Mr. Alfredo Staffa (1990)

Ms. Crystal Pallister (1991)

Mr. Vincent Christiano (1991)

Ms. Sarit Assouline (1991)

Ms. Lyle Le (1991)

Mr. Danny Lin (1991)

Ms. Catherine Poku (1991)

Mr. Abhinav Garg (1992)

Mr. Schachar Orenstein (1992)

Mr. Alex Meneshian (1992)

Mr. Vimal Scott Kapoor (1992)

Mr. Christos Karatzios (1992, 1993)

Mr. Michael Siedel (1999)

Ms. Yolanda Yim (1999)

**MEETING AND WORKSHOP ORGANIZATION**

1. Organizer - DNA Sequence Analysis Workshop - Montreal. PQ. August 18-20, 1981, 19 Participants
2. Symposium Organizer - "Genome Structure and Rearrangements". Annual Meeting of the Canadian Society of Microbiologists. May, 1982.
3. Symposium Organizer - "Canadian Manpower Needs for Biotechnology" (with Dr. David Thomas). Annual Meeting of the Canadian Society of Microbiologists. June, 1985.
4. **DIRECTOR AND ORGANIZER** Tenth Biennial Meeting on Bacteriophage Morphogenesis Ste. Anne de Bellevue, PQ. May 18-23, 1986 100 Participants - International.
5. Workshop Organizer - "Phage-Host Interactions" - Seventh International Congress of Virology. Edmonton, Alberta; August, 1987.
6. Symposium Organizer - "Regulation of Gene Expression" - Annual Meeting of the Canadian Society of Microbiologists. Laval, Québec; June, 1989.
7. Symposium Organizer - "Molecular Mechanisms of Toxicity" - Annual Meeting of the Society of Environmental Toxicology and Chemistry. Toronto, Ontario; November, 1989.
8. Workshop Organizer - "Lysogeny, Transposition and Evolution" - Eighth International Congress of Virology. West Berlin, FRG; August, 1990.
9. Meeting Organizer - Northeastern North American Chapter of the Society of Environmental Toxicology and Chemistry. Mont St.-Hilaire, Quebec; March, 1990, 1991.
10. Program and Advisory Committee - Fifth International Symposium on Toxicity Assessment. Kurashiki, Japan; May, 1991.
11. Symposium Organizer - "Genetic Recombination" - Annual Meeting of the Canadian Society of Microbiologists, St. John's Newfoundland, 1992.
12. Symposium Organizer - "Molecular Mechanisms of Toxicity" Sixth International Congress of Toxicology, Rome, Italy, 1992.
13. Workshop Organizer - "Lysogeny, Carrier State, Phage Conversion" - Ninth International Congress of Virology. Glasgow, UK; August, 1993.
14. Vice Chair - Organizing Committee of the Seventh International Symposium on the Genetics of Industrial Microorganisms. Montreal, Quebec; June, 1994.
15. Organizing Committee - Workshop on Plasmid Diversity. Montreal, Quebec; June, 1994.
16. Président - Section on Environment, 64<sup>th</sup> Annual Meeting of the Association canadienne française pour l'avancement des sciences (ACFAS) Montreal, May 1996.
17. Workshop Organizer - "Genetically-Programmed Responses to Metal Ion Exposure" - Fourth International Symposium on Metal Ions in Biology and Medicine. Barcelona (Spain); May, 1996.
18. Workshop Organizer - "Characterization of Genes involved in Environmental Stress" - International Congress of Stress. Budapest, (Hungary) July, 1997.

19. **DIRECTOR and ORGANIZER** - Annual Meeting of the Genetics Society of Canada. Montreal, Quebec. June, 1999.
20. Session Chair, Virology - 3<sup>rd</sup> Annual Meeting - Moroccan Biologists of Canada, May 1999.
21. Session Chair - "Biodiversity," Environmental Challenges for the Next Millenium, Jerusalem, Israel, June, 1999.

#### **Sponsorship of Outside Lecturers**

1. Doctor Martha Howe - University of Wisconsin (1981)
2. Doctor Arthur Landy - Brown University (1982)
3. Doctor James Shapiro - University of Chicago (1983)
4. Doctor Frans de Bruijn - Harvard University (1983)
5. Doctor David Friedman - University of Michigan (1985)
6. Doctor Malcolm Casadaban - University of Chicago (1985)
7. Doctor Thomas Gingeras - SIBIA (1986)
8. Doctor Marcel Bastin - Université de Sherbrooke (1986)
9. Doctor Graham Walker - M.I.T. (1988) - As Organizer of the Travelling Lectureship series of the Canadian Society of Microbiologists.
10. Doctor Douglas Berg - Washington University (1990)
11. Doctor Robert Schlieff - Johns Hopkins University (1990)
12. Doctor Diane Taylor - University of Alberta (1990)
13. Doctor Hikoya Hayatsu - University of Okayama (Japan) (1991)
14. Doctor Robert E. Webster - Duke University (1994)
15. Doctor Yves Brun - Indiana University (1996)
16. Doctor Arthur Koch - Indiana University (1998)
17. Doctor Brian Mee - University of Perth, Australia (1999)
18. Doctor Philippe Ross - Colorado School of Mines, Colorado (1999)

#### **Extramural Reviewing**

1. Medical Research Council of Canada: Operating Grants  
MRC Scholar applications
2. Natural Sciences and Engineering Research Council: Operating Grants,  
Strategic Grants
3. National Science Foundation (USA): Grants for Research
4. Cancer Research Society: Studentships
5. United States Environmental Protection Agency: Research Grants; Superfund.
6. United States Sea Grant Program
7. Alberta Heritage Foundation For Medical Research
8. Journals:
  - A. Water Research
  - B. Journal of Biochemistry and Cell Biology
  - C. Genetics
  - D. Journal of Bacteriology
  - E. Gene
  - F. Proceedings of the National Academy of Sciences (USA)
  - G. Journal of Molecular Biology
  - H. Microbial Ecology